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USE OF COLD GAS PROPULSION SYSTEM IN A 3U CUBESAT

Abstract

CubeSats have become quite popular especially among university students as these miniaturized satellites help them in carrying out space exploration feasibly. Till date, CubeSats have never flown in space with any well defined propulsion system. But in order to increase mission capabilities like orbit raising and formation flying , or to perform proximity operations , fine attitude control , drag make up and de-orbit without much risks , it is important to use a propulsion system . Here in this paper we have focused on the use of cold gas thrusters in a 3U CubeSat. Cold gas thrusters consist of a pressurized tank containing gaseous propellant, such as nitrogen, and a solenoid actuated valve system leading to exit nozzles. Since the propellant is unheated and relies solely on the enthalpy of the stored gas, the velocity at the nozzle exit is relatively low resulting in a low specific impulse, typically around 60 sec, useful for small attitude adjustments and low V maneuvers. However, the power level, pressure, and weight required in the vessel are though less, but still higher than the CubeSat Specifications provided by the CalPoly. A solution to this problem has been studied and discussed in this paper. Rather than relying on high pressure chambers, we propose the use of solid gas cartridges, which upon ignition by lasers can be released into a chamber containing the gas at a pressure slightly higher than the atmospheric pressure, from which nitrogen can be drawn for propulsive use. Moreover since only a fraction of the propellant is used for propulsion use, it helps in reducing the tank size and minimizes the risk of leakage and pressure limitations, with reduction in mass by around 20